FORTIETH ANNUAL REPORT

FOR 1920-21

OHIO
Agricultural Experiment Station

WOOSTER, OHIO, U. S. A., JUNE, 1921

BULLETIN 353

The Bulletins of this Station are sent free to all residents of the State who request them. When a change of address is desired, both the old and the new address should be given. All correspondence should be addressed to EXPERIMENT STATION, Wooster, Ohio

Fortieth Annual Report

OF THE

Ohio Agricultural Experiment Station

For the Year ended June 30, 1921

Published by the order of the State Legislature

WOOSTER, OHIO
EXPERIMENT STATION PRESS
1921

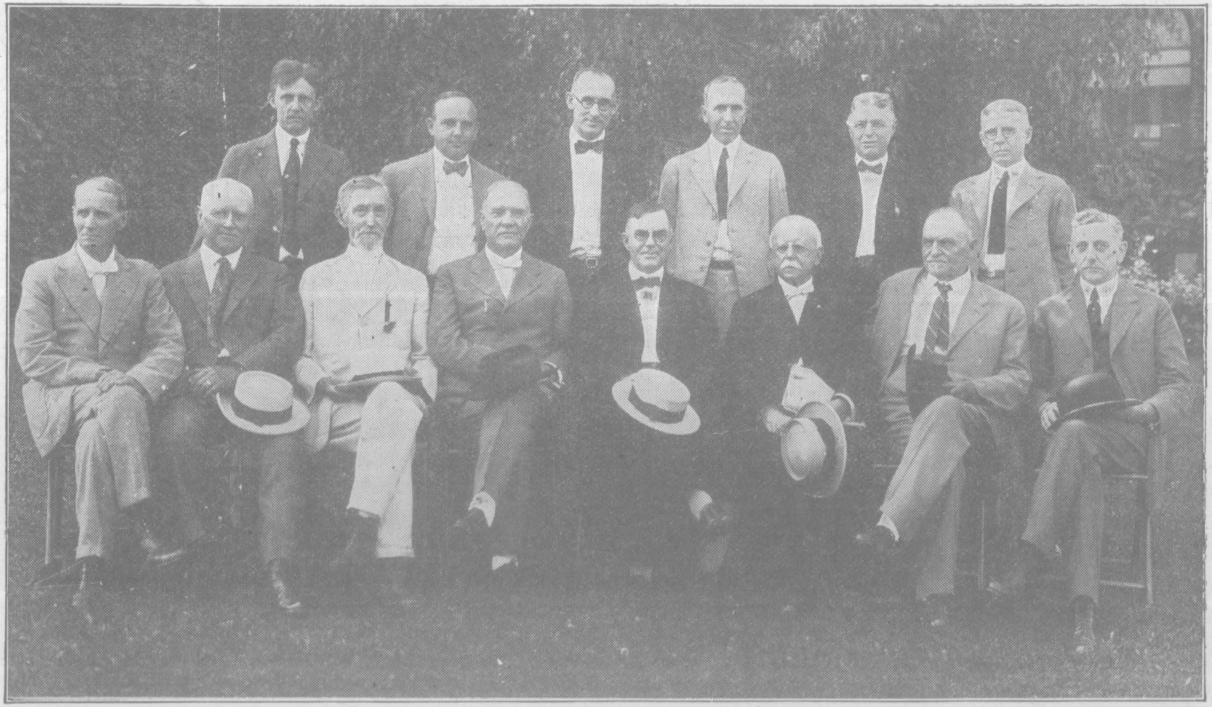
HON. HARRY L. DAVIS,

Governor of Ohio:

SIR: I have the honor to transmit herewith the Fortieth Annual Report of the Ohio Agricultural Experiment Station, for the year ended June 30, 1921.

G. E. JOBE,

President of the Board of Control



Members of the Board of Control and Trustees of the Ohio State University, with Secretary of Agriculture, Henry C. Wallace, at Wheatfield Day, Ohio Experiment Station, June 27:

Top row, left to right: W. H. Kramer, Carl E. Steeb, John F. Cunningham, Lawrence E. Laybourne, John Kaiser, C. G. Williams.

Bottom row: Geo. E. Scott, G. E. Jobe, Chas. E. Thorne, Dr. W. O. Thompson, Hon. Henry C. Wallace, Dr. T. C. Mendenhall, Chas. E. Flumerfelt and Benjamin F. McCann.

OHIO AGRICULTURAL EXPERIMENT STATION

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C. H. LEBOLD ..... Assistant Foreman

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FREDA DETMERS, Ph. D. ..... Assistant

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C. F. MONROE, B. S. ..... Assistant
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W. V. BALDUF, M. A., ... Assistant

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I. P. LEWIS, B. S. ..... Field Assistant
J. B. KEIL ..... Field Assistant
ORA FLACK ..... Foreman of Orchards
C. G. LAPER ..... Foreman of Greenhouses

SOILS

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J. W. AMES, M. S, *Associate* ..... Soil Chemistry
FIRMAN E. BEAR, Ph. D.[1] ..... Associate (Columbus)
G. W. CONREY, A. M., *Assistant*[1] ..... Soil Survey (Columbus)
A. BONAZZI, B. Agr., *Assistant* ..... Soil Biology

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G. M. DEGROFT ..... Assistant

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D. S. KIRBY, *Foreman*

Southeastern Test Farm, Carpenter
C. H. WILSON, *Manager*

Southwestern Test Farm, Germantown
HENRY M. WACHTER, *Superintendent*

Northwestern Test Farm, Findlay
JOHN A. SUTTON, *Superintendent*

COUNTY EXPERIMENT FARMS

Miami Co. Experiment Farm, Troy
Madison Co. Experiment Farm, London
H. W. ROGERS, *Supt.*, London, O.

Paulding Co. Experiment Farm, Paulding
H. R. HOYT, *Supt.*, Wooster

Clermont Co. Experiment Farm, Owensville
Hamilton Co. Experiment Farm, Mt. Healthy
W. E. WEAVER, *Supt.*, Mt. Healthy

Washington Co. Experiment Farm, Fleming
Washington Co. Truck Experiment Farm, Marietta
S. C. HARTMAN, M. S., *Supt.*, Marietta

Mahoning Co. Experiment Farm, Canfield
Trumbull Co. Experiment Farm, Cortland
J. PAUL MARKLEY, *Supt.*, Canfield

Belmont Co. Experiment Farm, St. Clairsville
C. W. MONTGOMERY, *Acting Supt.*, Wooster

STATE FORESTS

Waterloo State Forest, New Marshfield
JOHN WITHERS, *In Charge*

Dean State Forest, Steece
G. C. MARTIN, *In Charge*

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[1]In cooperation with College of Agriculture, Ohio State University.
[2]In cooperation with the U. S. Department of Agriculture.

ANNOUNCEMENT

The Ohio Agricultural Experiment Station is organized under an act of the General Assembly of Ohio, passed April 17, 1882, and supplemented by an act of Congress, approved March 2, 1887.

WHAT THE STATION CAN DO

The Station offers its advice and assistance to the farmers of Ohio along the following lines:

The maintainance of soil fertility, including the rotation of crops and the selection and use of manures and fertilizing materials.

The selection of varieties of grains, grasses and forage crops and methods of culture.

The selection of varieties of fruits and vegetables and the management of orchards.

The examination of seeds that are suspected of being unsound or adulterated; the identification of grasses, weeds and other plants; the prevention of fungous diseases of plants.

The identification of insects and the control of such as are injurious.

The feeding of animals, including calculation of rations and use of various feeding stuffs.

The planting and care of forest trees and the management of farm woodlots.

Visitors to the Station or its various test farms are welcome at all times during business hours. Persons or parties who contemplate such visits and who desire special attention are requested to write in advance, giving date of proposed visit and probable number of party.

Any citizen of Ohio has the right to apply to the Station for such assistance as it can give, and all such requests will receive prompt attention.

The bulletins of this Station are sent free to all residents of the State who request them.

Address all communications to

Experiment Station,

Wooster, Ohio.

WHAT THE STATION CANNOT DO

For advice and assistance along the following lines, application should be made to the Ohio State Board of Agriculture, Columbus, not to the Experiment Station.

The analysis of commercial fertilizers, of lime or limestone for agricultural purposes, and of feeding stuffs.

The treatment of contagious diseases of animals.

The inspection of orchards and nurseries for the control of San Jose scale.

The examination of foods, drugs, and dairy products suspected of being adulterated.

The Station is not prepared to analyze drinking water; requests for such analysis should be addressed to the Secretary of the State Board of Health, Columbus.

THE REPORT OF THE DIRECTOR

HON. G. E. JOBE,
President of the Board of Control.

Sir: I have the honor to present herewith the fortieth annual report of the Ohio Agricultural Experiment Station, for the year ending June 30, 1921.

RESIGNATIONS OF DIRECTOR CHARLES E. THORNE AND WILLIAM J. GREEN, HORTICULTURIST

In accordance with a determination made known to the Board of Control 2 years previous, Director Charles E. Thorne requested that his resignation be accepted in January, 1921, that he might devote his time to the interpretation of the unusual amount of data which had accumulated in his work in soil fertility. The Board reluctantly acceded to his request, though realizing the reasonableness of it after 34 years of continuous service as Director of the Ohio Station. Director Thorne continues his connection with the Station as chief of the department of soils.

For a somewhat longer period—38 years—William J. Green has served the Station as chief of the department of horticulture. Upon his urgent request his resignation as chief of the department was accepted, but Mr. Green was induced to continue his services to the Station as Consulting Horticulturist.

NEW LEGISLATION

Under an Act of the Legislature passed April 19, 1921, in which a general reorganization of the State government was provided, Section 1171-2 of the General Code providing for the appointment of a Board of Control of five members was repealed, and the Director of Agriculture and the members of the Board of Trustees of the Ohio State University were made the Board of Control of the Experiment Station, the new board to assume its duties July 1, 1921.

The legislature also passed House Bills 255, 256 and 257, relating to forestry matters. In brief these bills provide for the appointment of a state forester and fire wardens, and for the prevention and suppression of forest fires; for the establishment of a State forest nursery, and authorize the creation of municipal, township or county forests and provide for a levy of a tax therefor. Section 1 of Bill 255 provides that "the chief of the department of forestry of the Ohio Agricultural Experiment Station shall be ex-officio state forester."

In January, 1919, action was taken by the Board of Control uniting the departments of animal husbandry and nutrition in a new department of animal industry, as recorded in the thirty-eighth annual report. This action went into effect as of August 1, 1920, as a result of decisions of the county and district courts in favor of the Station administration.

AGRONOMY

The various long-time projects of the department have been continued. In the improvement of varieties of wheat by selection, the pecularities of the season influence to a large degree the direction of the selection. The winter of 1919-20 was very severe resulting in much winter-killing. The selections made in 1920 were accordingly in the direction of greater hardiness. The winter of 1920-21, on the contrary was very mild, with very little winter-killing; but the quality of the grain was very inferior and much loose smut was in evidence. Selections taken during the present season were based largely on quality of grain and freedom from smut.

The effect of harvesting corn at different stages of maturity is being studied with reference to yield of shelled corn and the quality of the seed. The latter is to be determined by freedom from disease, vigor of germination and comparative yield the following year.

The effect of seeding timothy in wheat is being studied with reference to the yield of wheat and of the hay following. The timothy is seeded as follows: all in the fall, all in the spring, half in fall and half in the spring, and is being omitted entirely. A uniform seeding of clover is made in the spring.

The work on the lodging of small grains for the last year has consisted chiefly in an effort to discover what cultural methods, if any, are associated with lodging.

Work has been done along morphological and ecological lines.

A study of the structure of the stems of wheat and oat plants grown under different cultural conditions has been made. The cultural practices under consideration involving different situations are: rate of seeding, manner of seeding, quality of seed and effect of fertilizer. A study is being made also of different varieties of wheat and oats; some especially weak in straw; others notably stiff. This work is being done by Dr. P. D. Strawsbaugh, head of the department of botany, Wooster College.

A study of the environmental conditions surrounding the situations under which wheat and oats have been observed most frequently to lodge has been carried on. This has included the determination of moisture and nitrate content of the soil; and the determination of the rate of evaporation of moisture from the soil and the wind velocity.

Publications.—*Monthly Bulletin.* "Wheat: Variety and Cultural Work," July, 1920, C. G. Williams. "Longevity of Seeds," Jan.-Feb., 1921, F. A. Welton. "Annual White Sweet Clover," Jan.-Feb., 1921, L. E. Thatcher. "Oats Variety Test at Ohio State University," March-April, 1921, J. B. Park.

ANIMAL INDUSTRY

The work of this department the past year has been largely a continuation of the work of recent years. Additional work with swine is as follows:

Hogging down corn without any supplement, with a protein supplement, and with crops grown with the corn. A comparison of harvesting and feeding the corn with hogging down was also made.

Further studies of self and hand-feeding, both in dry lot and on forage have been made. These included tests to determine whether a pig's instinct enables it always to select the feeds before it in proportions which will give the optimum results possible from those particular feeds especially when there is a difference in their palatability.

A test of different percentages of fiber in rations for fattening swine has been started: one with whole oats (ground), with hulled oats or oat kernels, and with mixtures of hulled oats and re-ground oat hulls intermediate in percentage of fiber. Another in which highly fibrous and relatively inert material was added to a basal ration low in fiber.

Publications.—Bulletin 347, "The Utilization of Calcium Compounds in Animal Nutrition," E. B. Forbes, J O. Halverson, L. E. Morgan, J. A. Schultz, E. B. Wells, C. H. Hunt and A. R. Winter. Bulletin 349, "Supplements to Corn for Fattening Swine," W. L. Robison. *Monthly Bulletin*: "Mineral Feeds for

Farm Animals," July, 1920, E. B. Forbes. "Corn By-products for Swine," September, 1920, W. L. Robison. "Effects of Rations upon the Hatchability of Eggs," October, 1920, W. J. Buss. "Full and Limited Feeding of Fall Pigs," Nov.-Dec., 1920, W. L. Robison. "Forage for Swine," March-April, 1921, W. L. Robison.

BOTANY

The work of this department for the fiscal year has been exacting and diverse, with rather extreme development of many lines of plant diseases. In 1920 and 1921 there have been so many severe plant disease infections that it has been impossible to answer all the calls for investigation.

Diseases of cereals and other field crops have received considerable attention. This has included advice and directions for the treatment of seed wheat for the prevention of smut and scab, and of oats for smut and other diseases; a study of the powdery mildew, glume spots, orange leaf rust and black stem rust of wheat; and cooperation with the office of Cereal Investigations of the U. S. Department of Agriculture to discover whether the "take-all" and flag smut diseases of wheat have been introduced into the State.

An Adams project in cooperation with the departments of agronomy and farm management has been arranged for the study of corn root rot and ear mold, and clover root rot.

A study of the impairment of red clover seedings in Champain and counties west and southwest has been made; a preliminary mention of which is made in the May-June Monthly Bulletin. This appears to be associated with a species of fusarium wilt.

Diseases of greenhouse vegetables have been the subject of frequent calls for investigation and advice. The results of a study of the bacterial rosette of lettuce by Roy C. Thomas, is nearly ready for publication. The results of a similar study of the Botrytis rot and wilt of the tomato made by him in 1920 was published in the March-April Monthly Bulletin. A thorough sterilization by the formaldehyde drench as described in Circular No. 151, or steaming the beds by means of inverted pan and perforated steam pipe, has been recommended for the many cases of diseased greenhouse soil.

Among the diseases of garden vegetables calling for investigation were a new type of celery root rot and the point rot of tomatoes favored in places, especially in the Marietta district, by the severe drouth of early summer. A project is under way to develop strains of early cabbage resistant to fusarium disease or yellows.

Potato diseases have received much attention. Miss Freda Detmers, in cooperation with county agents, has examined many samples of seed potatoes for late blight and other diseases which may be under way at the Station to determine the efficacy of soil treatment and of the use of sulphur in the reduction of scab.

Diseases of orchard fruits and methods for their control have continued to demand much attention. Following the conditions of 1920, the season of 1921 has shown the need for the use of a strong fungicide at the pre-blossom stage to control apple scab and the application of Bordeaux mixture for the later infections of black rot and blotch. Plans to conduct spraying demonstrations and studies in cooperation with the Extension Service of the Ohio State University and extending over 3 years have been developed. The acute condition early in 1921 called for a leaflet giving an apple-spraying program to supplement that published in the Monthly Bulletin for March, 1920.

Cherry root rot diseases in Lucas County are subjects of special investigation by Roy C. Thomas. Many raspberry and blackberry plantations have shown diseased conditions and the work in Cuyahoga County by R. B. Wilcox of the Bureau of Plant Industry has been followed closely.

Diseases of forest and shade trees and ornamental plants have been investigated by Miss Freda Detmers. An outbreak of poplar canker in plantings of a paper company in Ross County was determined to be of parasitic origin. Further studies were made for the control of the disease of Scotch pine seedlings in the seedbeds of the Dean State Forest. The prevalence of aster wilt due to a species of fusarium has called for frequent examinations of diseased plants and for the publication of a leaflet.

The cigar tobacco breeding work at Germantown has been continued. Seed of the new and improved varieties was distributed to 164 growers in the Miami district and to growers in other parts of the State.

Members of the department cooperated with members of the Extension Service of the Ohio State University in the preparation of a report listing the plant diseases occurring in Ohio during the season of 1920. The department also continues to cooperate in the plant disease survey of the Bureau of Plant Industry of the U. S. Department of Agriculture by reporting upon the occurrence and methods of control of crop diseases and by special semi-monthly reports on particular diseases. The results are published in the bul-

letin of the plant disease survey and are also issued in mimeograph form. A complete list of all the plant diseases found in the State is kept on file at the Station.

Publications.—*Monthly Bulletin*: July, 1920, "Bordeaux Mixture an Active Fungicide," by A. D. Selby and R. C. Thomas. August, 1920, "Root Rot of Tobacco," by True Houser. January-February, 1921, "Brown Rot of Peaches and its Control," by R. C. Thomas. March-April, 1921, "Botrytis Rot and Wilt of Tomato," by R. C. Thomas. May-June, 1921, "Impairment of Clover Seedings Reported," by A. D. Selby and R. C. Thomas. *Leaflet:* March 12, 1921, "Application of Pre-Blossom Bordeaux Spray Advised for Apple Scab, Northern Ohio," by A. D. Selby. *Leaflet*: August 10, 1921, "Fusarium Wilt or Stem Rot of China Asters," by Freda Detmers.

CHEMISTRY

During the past year the work of the department has included the following projects:

(Adams Project) Phosphorus combinations and availability in soils.—The work on this project has included studies with different types of soils in outdoor pot-experiments and the assimilation of phosphorus by crops grown on soils treated with rock phosphate and supplemental fertilizers.

Sulphur in relation to soils and crops.—The experimental work on small plots, which was started for the purpose of studying the effect of sulphur on crop yields and soil conditions with respect to changes in reaction and composition, has been continued.

The weights of crops from the plots which have been treated for several years have furnished indications that sulphur has had some slight influence on some of the crops grown. But the results so far obtained are not sufficiently positive to justify the conclusion that sulphur has been beneficial on this soil.

Additional work under this project was begun on Clyde clay soil at the Paulding County farm during the past year. In this experiment corn, soybeans, wheat and clover are to be grown in rotation on a series of one-twentieth acre plots. The soil treatment on four blocks of 11 plots each, includes elemental sulphur and calcium sulphate used alone and supplemented with fertilizers supplying nitrogen, phosphorus and potassium.

(Adams Project 16) Potassium supply of the soil.—The purpose of the investigation outlined under this project is to determine to what extent lime and various fertilizing materials, including gypsum, nitrate of soda, ammonium sulphate and phosphates are effective agencies for converting the large supply of soil potassium into more available forms that may be utilized by crops.

The influence of cropping on the exhaustion of the active potassium of the soil is also being considered as a part of the investigation.

The work on this project during the past year has furnished interesting and suggestive results regarding the phenomena of liberation and fixation of potassium in soils. The indications are that whatever effect calcium sulphate, sodium nitrate and other materials may have for increasing the availability of potassium, it is chiefly that of releasing potassium which has accumulated in an absorbed or fixed condition, after the continuous breaking down of potassium

minerals by various agencies. These materials release more potassium from soil that has received additions of soluble potassium salts for a period of years, than from unfertilized soil. The absorbtion of soluble potassium salts is less when the soil has been fertilized with potassium.

One encouraging feature of the work on field soils is the correlation between the crop removal of potassium as associated with certain fertilizer treatment, and the potassium extracted from the soil.

Influence of silicates on growth of plants and on their utilization of phosphorus.—The favorable effects of blast furnace slag and other silicates on crop growth are attributed to the calcium and magnesium furnished. Increased amounts of silica were assimilated by plants grown on soil receiving additions of different forms of soluble and insoluble silicates. No evidence was obtained that the utilization of phosphorus by plants was appreciably influenced by added silicates.

Milling and Baking Technology.—Milling and baking tests of a large number of different varieties of wheat have been made to aid in the standardization of wheat grown in the cereal improvement investigations of the Station. Studies of wheat grown in several counties of the State under different soil and weather conditions are in progress.

Publications.—Bulletin 350, "Wheat, Flour and Bread," Mabel K. Corbould; Bulletin 351, "Solvent Action of Nitrification and Sulfofication," J. W. Ames; *Monthly Bulletin*: "How Beet Sugar is Made," July, 1920, J. W. Ames; Scientific Journals: "Lime Requirement and Reaction of Lime Materials with Soil," C. J. Schollenberger, Soil Science, Vol. XI, No. 4, p. 261. "Organic Phosphorus Content of Ohio Soils," C. J. Schollenberger, Soil Science, Vol. X, No. 2, p. 127.

DAIRYING

The work of the department the past year has been as follows:

A comparison of rations containing an excess and a deficiency of protein with a normal ration has been under way since 1911. As stated in a previous report, disease and the lack of regularity in breeding has interfered seriously with this work. During the present summer a digestion test was conducted on four of these cows (two from the wide and two from the narrow ration) to determine the difference in efficiency of digestion, if any, between the two rations. Unless it is deemed best to change the plan and study some particular phase of the subject, the project probably will be discontinued soon. It seems that sufficient data have been collected in its present form.

A study of the relative values of silage made from the ordinary field corn and that made from the large "silage corn" is under way. Five tests have been completed and the data are being prepared for publication. These tests show some difference in nutritive value per unit, in favor of the silage from the field corn; but when placed on the acre basis, this difference is exceeded by the greater yield of dry matter per acre by the silage corn. The difference in efficiency of the field corn (Clarage) over the silage corn (Blue Ridge), per unit, was about 4 percent or less. The difference in yield per acre was about 9 percent in favor of the Blue Ridge. The difference in milk production in favor of the Blue Ridge silage will be from 4 to 5 percent.

Although the Station has for many years maintained a herd of purebred cattle, no testing for advanced registry was done until June 1, 1919, when one Jersey cow was started on a yearly test. Others have been added and the following cows completed their records during the year, July 1, 1920 to June 30, 1921.

OFFICIAL TEST RECORDS OF COWS
Ohio Experiment Station

Number	Age		Milk	Fat	Butter (80%)
	Year	Month			
			Pounds	*Pounds*	*Pounds*
Holsteins					
57	11	11	21,177	711.	888.
65	10	9	18,258	533.8	667.5
70	9	10	17,492	592.1	740.2
107	7	0	22,161	753.	941.
104	7	0	16,416	530.9	664.
124	6	2	20,377	762.9	953.
109	7	3	15,001	520.6	650.
92	8	5	19,400	643.5	804.
Jerseys					
143*	4	6	10,211	583.4	729.
112	6	9	11,699	618.4	773.
96	8	0	9,412	500.9	626.
119	6	5	10,768	614.2	767.
159	4	3	8,728	516.3	645.
106	7	4	8,710	465 5	581.
105	7	5	8,186	445.4	556.

*Completed before July 1, 1920.

Others are on test and making creditable records.

The work on inbreeding is being continued, but it has been greatly interfered with by the presence of abortion disease, which has caused the loss of calves and the failure of some cows to breed. This same disease together with infectious scours in calves has practically made impossible careful, reliable experiments in calf feeding. It has also so disarranged the breeding schedule that it is difficult to conduct feeding tests with cows, because large groups freshening close together are desirable for such tests.

Some other minor projects are under way, but no report of progress can well be made now.

Publications.—*Monthly Bulletin*: "Official Tests in Station Herd", May-June, 1920, C. C. Hayden.

ENTOMOLOGY

The following is a resume of the activities of the department:

(1) Considerable time has been devoted to Hessian fly control. The practicability of using cages to determine the time of issuance of the flies, sticky screens to catch them in flight and thus determine their dates of activity in the field, and egg-laying records taken daily from a given number of wheat plants cleaned each day, were all tested and checked against each other to discover the safe dates for sowing wheat.

A station was maintained at Sandusky, another at Bryan and one each at Wooster and Columbus. The maintenance of all these stations was made possible by the cooperation of the entomologists at the State University and in the State Department of Agriculture. By these devices it was proved that the seeding dates which had been chosen on the basis of previous experience were too early and the farmers over all northern Ohio were persuaded to delay their sowing a few days through their farm bureaus. The results obtained indicated beyond question that disastrous infestation of wheat for most of northern Ohio was prevented by these devices and by the well-organized publicity service directed by the extension entomologist of the University through the Farm Bureaus.

(2) Dusting experiments in apple and peach orchards were conducted at Waterville and Lorain. From an entomological standpoint these experiments were successful and in 1920 were fairly successful from a fungicidal standpoint, but during the summer of 1921 they signally failed to control apple scab and apple blotch. Thus far the experiments with peaches are not discouraging.

(3) A full report on "The Dissemination of Fire Blight" was prepared during the year.

(4) Studies of the apple flea weevil are completed and a successful control measure has been found, which consists in practicing clean cultivation. Old sod orchards so treated have been wonderfully revived. An arrangement for cooperative publication with the Illinois Station has been arranged, thus enabling each institution to give a more complete and satisfactory treatise than either could prepare alone.

(5) Work on the striped cucumber-beetle has been continued and the correctness of previous records and control measures confirmed. All gaps in the life history are now filled. A complete bulletin on this insect will soon be ready.

(6) Observations have again been taken on the life history of the codling worm at Marietta, Wooster and Lorain.

(7) Life history studies have been made at Marietta on the corn ear worm, imported cabbage worm and asparagus beetle.

(8) A study of insects affecting soybeans has been made at Marietta.

(9) Dr. Herbert Osborn has continued his comprehensive studies of grass and forage insects.

Publications.—*Monthly Bulletin*: "Wheat Sowing Dates to Avoid Hessian Fly", September, 1920, by T. H. Parks. "Hessian Fly Prevention," May-June, 1921, by H. A. Gossard and T. H. Parks. "Hessian Fly Prevention," "Journal Economic Entomology," February, 1921, by H. A. Gossard and T. H. Parks.

FARM MANAGEMENT

During the year but little new work was started on any of the county and district experiment farms, partly because the land is fairly well occupied, and partly because there was some uncertainty as to what the labor situation for the year would be.

However, men are coming to these farms for work and there is better opportunity than for some years to select labor qualified

to do the work; the price of labor has not yet declined with the price of farm crops and there is some difficulty in making receipts pay expenses.

As the work continues it has been found desirable to make some changes in the crop rotations on some of the farms. At the Trumbull County farm the 2-year rotation of corn and rye, both grown for silage, and a rotation of corn, rye and soybeans, have been dropped and a rotation of corn, corn, oats and peas, alfalfa and alfalfa has been started; also a rotation of corn, oats and sweet clover. After the land has been tile-drained, and lime and phosphorus added, alfalfa does well on the Trumbull County soil.

At the Truck Experiment Farm in Washington County the high price paid for hay was noted, also the great mass of forage cowpeas produced when sown as a cover crop for plowing under. The question arose, "Would it not be more profitable to cut the peas for hay to feed the horses and invest the money thus saved in commercial fertilizers? Accordingly, experiments were started to help solve the problem and others to test the comparative value of different leguminous crops for soil improvement work.

Permanent Improvements.—Two thousand and ninety-nine rods of tile have been laid on the Hamilton County experiment farm and 500 rods on the Clermont County experiment farm. On one field of 20 acres on the Hamilton County experiment farm the laterals were laid 30 inches deep and 36 feet apart, the cost of laterals and main installed complete being $83.73 per acre or $1.31 per rod.

Outside Work.—The only work outside the farms that the Department has performed has been to assist the Office of Farm Management, United States Department Agriculture, to survey a number of farms in Barlo Township, Washington County, also to assist the Department of Rural Economics, Ohio State University, in making a survey of a number of truck farms in the vicinity of the Truck Experiment Farm, Washington County.

Publications.—*Monthly Bulletin*: May-June, 1921, "Installing Drainage System on the Washington County Experiment Farm", S. C. Hartman; "What Crop Rotations Show", Cary W. Montgomery.

FORESTRY

The work of the department is largely a continuance of that mentioned in previous reports. Investigations and experiments in forestry are largely those which must extend over a considerable period of time for the attainment of definite results.

Owing to the forestry situation in the State as elsewhere in the nation it has seemed best to devote considerable effort to assisting private landowners in the improvement and management of

woodland tracts as well as reforesting waste and idle lands. Similar assistance has also been given to municipalities and public institutions owning lands suitable for forestry purposes. In all cases examinations of woodland or planting sites have been made by members of the department staff, and written reports submitted to the owners.

The following lines of work are under way:

1. **Propagation of forest trees.**—(a) Fertility experiments on coniferous and hardwood seedbeds. (b) Methods of seeding coniferous and hardwood planting stock.

2. **Reforestation.**—Adaptation of tree species to different soil and site conditions for forest plantations, windbreaks, and shelter belts.

3. **Forest Arboretum.**—Small plantations of trees are being established on state, municipal, and public lands for more intensive study of the value and behavior of the different species for reforestation purposes in pure stands and mixtures, and also for obtaining accurate growth data.

4. **Forest management.**—(a) Thinning experiments in native woods and in artificial forest plantations are being carried on in different sections of the State. (b) Experiments in the improvement and renewal of the different types of farm woods are being carried on throughout the State in both public and private lands.

5. **Wood utilization.**—(a) The study of the relative durability of several species of timber for post purposes is being continued. This data will be used in the revision of Bulletin 219.

6. **Municipal forestry.**—The development of the municipal forests at Oberlin and Cincinnati is being continued under the direction of the Station Forester. Five hundred thousand trees have been planted on the old fields of the Cincinnati forest since 1914.

7. **The State Forests.**—Planting operations are being continued at Dean and Waterloo State Forests. The forest nursery at Dean contains approximately 750,000 trees.

8. **The Forest Survey.**—The field data in Pike and Scioto counties have been completed, and the type and stand maps have been completed for these two counties. Field work on Lawrence and Adams counties is completed.

Publications.—*Monthly Bulletin*: "Fire Protection for Forest Lands", Nov.-Dec., 1920, Edmund Secrest. "Forest Planting", Mar.-Apr., 1921, Edmund Secrest.

HORTICULTURE

The long time projects in this department have continued without interruption during the past year. No new projects have been undertaken aside from those of minor nature.

1. **Varieties of tree fruits.**—For many years this station has made special studies of fruit varieties and has accumulated a very large collection which has yielded an invaluable set of records of tree and fruit characteristics. Not only is it important to maintain such extensive collections under institutional

management but the plant breeder, the fruit-products worker and student in general must use such an orchard as the source of much fundamental information.

2. **Tree records.**—Aside from a study of fruit characteristics phenological data are also recorded, such as blossoming dates, time of picking, and frost records. The yield of each tree has been kept for a period of years and thus it is possible to locate low and high-yielding individuals.

3. **Pruning apple trees.**—A project on the pruning of the apple is now in its sixth year and already brings out the fact that light dormant pruning will result in earlier and heavier bearing than the more extreme types of pruning.

4. **Peach fertilization.**—This work has continued in an orchard on Catawba Island. The results of the past year again demonstrate the value of nitrogen fertilizer with this fruit. Owing to the age and condition of the trees however, work in this orchard will be discontinued after this year.

5. **Currant varieties.**—This project has been continued and habits of the different varieties recorded, but owing to a freeze no yield records were obtained this season. Through the courtesy of the United States Department of Agriculture additions to the large collection of varieties are still being made from European sources.

6. **County experiment orchards.**—Orchards, small fruits and grapes have been planted on several of the county farms and they are now coming into bearing. The work of the central station is greatly enhanced by this work as the behavior of varieties under the various climates and soil conditions can be noted. Demonstrations of various types of pruning, spraying, culture and fertilizer treatments are yielding striking results.

7. **Strain selections of lettuce.**—Aside from the extension study of fruit characteristics, no other long time project has received greater attention by this department than the improvement of vegetable varieties both in the field and greenhouse. The work with lettuce is outstanding in the results secured by consistent mass-selection. The Grand Rapids variety has received more attention than any others, and as a result of the work two types have been selected. One is of a light color and the other of a dark color. The latter is designed especially for winter forcing as it blanches well on the inside of the dense head, and is much more vigorous than any other known strain of this lettuce. The light strain is superior to the usual varietal type. Some important results have also been secured in selections of spinach, kohl-rabi and cucumbers and a report of them will be made soon.

8. **Disease resistance.**—Selections are being made in an attempt to eliminate through breeding, some of the serious disease pests of vegetables. Such diseases as bean anthracnose, fusarium wilt of tomatoes, and "yellows" of cabbage are included in the selection work.

9. **Vegetable fertility work.**—This work is being conducted at Wooster, and at the Washington and Mahoning county farms. At the latter places the cost of production and profits are also kept through the cooperation of the Department of Farm Management. The treatments have continued sufficiently long to yield more valuable data on the best fertilizer treatments for the various crops. On the soil in Washington County which is particularly adapted to early vegetable production, the unfertilized plots are greatly surpassed in yield by those receiving any fertilizer or manure treatment in the test.

Publications.—*Monthly Bulletin*: "Home Production of Vegetable Seeds", July, 1920, J. B. Keil; "Varieties of Apples Adapted for Ohio Culture", September, 1920, Paul Thayer, J. B. Keil, and W. J. Green; "Cellar Storage of Vegetables", October, 1920, J. B. Keil; "Apples Adapted for Ohio Culture", Octobeer, 1920, W. J. Green, Paul Thayer, and J. B. Keil; "Growing Garden Beans", Nov.-Dec., 1920, J. B. Keil; "Characteristics of Peach Varieties", Jan.-Feb., 1921, Paul Thayer; "An Orchard Tragedy", Jan.-Feb., 1921, F. H. Ballou; "Ensee Apple", Jan.-Feb., 1921, F. H. Ballou; "The Gardener and the Seedsman", Jan.-Feb., 1921, J. B. Keil; "Ten-year Yield Record of Apples", March-April, 1921, C. W. Ellenwood.

SOILS

The study of the soil has been continued along the lines previously reported upon, and may be classified under the heads of soil chemistry, soil biology, soil survey and soil treatment.

Soil chemistry.—This work is conducted by the Department of Chemistry, and has been reported upon by that department.

Soil biology.—The work under this head has been a continuation of Adams Fund projects No. 4, the Physiology of Nitrification, and No. 5, Azotobacter studies. A report of the work thus far accomplished under Project No. 4 is to be found in the Journal of Bacteriology, Vol. 6, No. 5, and of that under Project 5 in the same journal, Vol. 6, No. 3, 1921.

Soil survey.—This work has been conducted in cooperation with the Bureau of Soils, United States Department of Agriculture. During the year the surveys of Fulton and Wayne counties were continued. The report for Lucas County is being completed. Madison and Clermont counties will be taken up next.

Soil treatment.—Forty-two experiments are now in progress, located in 14 counties, in which crops are grown under varying conditions as to soil or rotation or fertilizing.

In the rotation of potatoes, wheat and clover at Wooster the wheat has yielded a 27-year average of 38.3 bushels per acre on Plot 14, and 8 other plots have averaged 36.7 bushels. In these cases the fertilizers have been paid for by the increase in potatoes and clover.

This example illustrates the objective point in all the work of this department, namely: the reduction of the cost of producing the crop unit.

Publications.—*Monthly Bulletin*: "Chemical Analysis of Soils," August, 1920, Firman E. Bear; "Fertility Experiments at the Ohio State University", October, 1920, Firman E. Bear; "Fertilizing the Corn Crop", March-April, 1921, C. E. Thorne; "Fertilizing the Oats Crop", March-April, 1921, C. E. Thorne; "Studies on Azotobacter Chroococcum Beij", A. Bonazzi, Journal of Bacteriology, Vol. 6, No. 3; October 15, 1920; "The Carbon and Nitrogen Relations of the Nitrite Ferment", A. Bonazzi, Journal of Bacteriology, Vol. 6, No. 5, 1921.

PERSONNEL

The following changes in the personnel of the scientific and managerial staffs of the Station have occurred during the year:

APPOINTMENTS

C. F. Monroe, assistant in dairying; O. A. Alderman, assistant in forestry; G. M. DeGroft, assistant in farm management; W. E. Weaver, superintendent county farms; C. G. Williams, acting director, and later director; V. H. Morris, assistant in chemistry; D. C. Kennard, associate in animal industry; P. S. White, assistant in animal industry; J. H. Gourley, chief in horticulture.

RESIGNATIONS

E. B. Forbes, chief in animal industry; W. E. Bontrager, forman of grounds; C. E. Thorne, director; W. J. Green, chief in horticulture; W. J. Buss, assistant in animal industry.

Respectfully submitted,

C. G. WILLIAMS,
Director.

REPORT OF THE BURSAR

HON. G. E. JOBE,
President of the Board of Control.

Sir: I respectfully submit the financial report of the Ohio Agricultural Experiment Station for the fiscal year ended June 30, 1921.

In statements A, B, C, D, E, F and G will be found a record of the receipts and expenditures from the various funds; statements A and B being statements of account with the appropriations received from the National Government and a copy of the report made to the Governor of the State, to the National Secretary of Agriculture, and to the National Secretary of the Treasury; statement C being a statement of account with the United States Produce Fund; statement D being a statement of the account with the State appropriations and Produce Fund; statement E being a statement of account with the Rotary Funds.

The five statements, A, B, C, D and E, are combined in statement F, which shows the total income and expenditures for the fiscal year.

Statement G is a balance sheet which shows the condition of each fund at the close of business, June 30, 1921.

Respectfully submitted,

W. H. KRAMER,
Bursar.

STATEMENT A

HATCH FUND

The Ohio Agricultural Experiment Station in Account with the United States Appropriation under the Hatch Act for 1920-21

Dr.

To receipts from the Treasurer of the United States, as per appropriation for the fiscal year ended June 30, 1921, as per act of Congress approved March 2, 1887 ..... $15,000.00

Cr.

By expenditures for:

Salaries	$6,964.76
Wages	4,481.44
Forage supplies	197.49
Agricultural supplies	539.96
General plant supplies	73.73
General plant materials	572.73
Educational equipment	56.35
General plant equipment	363.78
Repairs	163.60
Freight, express and drayage	1,469.97
General plant service	116.19
Total	$15,000.00

STATEMENT B

ADAMS FUND

The Ohio Agricultural Experiment Station in Account with the United States Appropriation under the Adams Act for 1920-21

Dr.

To receipts from the Treasurer of the United States, as per appropriation for the fiscal year ended June 30, 1921, as per act of Congress approved March 16, 1906 ..... $15,000.00

Cr.

By expenditures for:

Salaries	$9,954.10
Wages	2,872.95
General plant supplies	1,087.52
General plant materials	266.90
Educational equipment	17.17
General plant equipment	738.96
General plant service	52.40
Insurance	10.00
Total	$15,000.00

STATEMENT C

ADAMS PRODUCE FUND

The Ohio Agricultural Experiment Station in Account with the United States Produce Fund

Dr.

To Receipts

From Sale of hogs	$2,473.87	
" Sale of miscellaneous items	67.50	
Total		$2,541.37
To balance forward July 1, 1920		1,589.32
Total		$4,130.69

Cr.

By Expenditures

Wages	$1,162.96	
Forage supplies	137.74	
Livestock	175.25	
General plant service	8.00	
Total		$1,483.95
By balance forward		2,646.74
Total		$4,130.69

STATEMENT D

The Ohio Agricultural Experiment Station in Account with the State and Produce Funds

Dr.

To Receipts

From	State appropriations	$265,365.00	
"	Department of Administration	2,270.13	
"	Department of Agronomy	2,239.31	
"	Department of Animal Industry	1.20	
"	Department of Botany	2.88	
"	Department of Dairy	3.00	
"	Department of Entomology	.25	
"	Department of Forestry	413.25	
"	Department of Horticulture	6,761.45	
"	Northeastern Test Farm	500.71	
"	Northwestern Test Farm	387.63	
"	Southeastern Test Farm	1,142.62	
"	Southwestern Test Farm	381.81	
	Total		$279,469.24
	To balance forward July 1, 1920		154,961.31
			$434,430.55

Cr.

By Expenditures

For	Salaries	$127,765.11	
"	Wages	67,116.53	
"	Wages, unclassified	188.87	
"	Forage supplies	9,545.39	
"	Fuel supplies	8,311.45	
"	Office supplies	1,549.88	
"	Cleaning supplies	209.01	
"	Agricultural supplies	2,679.89	
"	General plant supplies	8,152.50	
"	Building materials	1,835.88	
"	General plant materials	2,780.23	
"	Office equipment	149.77	
"	Livestock	555.00	
"	Agricultural equipment	942.10	
"	Educational equipment	928.34	
"	General plant equipment	8,575.72	
"	Repairs	2,011.87	
"	Light, heat and power	173.26	
"	Freight, express and drayage	2,773.81	
"	Traveling expenses	12,979.64	
"	Communication	507.90	
"	General plant service	1,575.21	
"	Rent	2,665.91	
"	Insurance	138.50	
"	Contributions	379.69	
"	Land	25,951.90	
"	Fencing	599.08	
"	Reservoir	1,475.00	
	Total		$292,517.44
	*State Treasury		14,104.24
	By amount lapsed to State Treasury		90,014.54
	By balance forward		37,794.33
	Total		$434,430.55

*Deposited in State Treasury to the credit of the General Revenue Fund.

STATEMENT E

Ohio Agricultural Experiment Station in Account with the Animal Industry and Dairy Rotary Funds

ANIMAL INDUSTRY ROTARY FUND

Dr.

To Receipts

From	Sale of cattle	$3,379.87	
"	Sale of eggs	3,704.85	
"	Sale of hogs	5,310.07	
"	Sale of poultry	1,090.64	
"	Sale of sheep	1,264.22	
"	Sale of wool	2,425.59	
"	Sale of miscellaneous items	19.99	
	Total		$17,195.23
	To balance forward July 1, 1920		4,407.28
	Total		$21,602.51

Cr.

By Expenditures

For	Wages	$8,450.48	
"	Forage supplies	9,836.88	
"	General plant supplies	11.00	
"	Livestock	300.00	
"	Freight, express and drayage	471.14	
"	General plant service	28.00	
	Total		$19,097.50
	By balance forward		2,505.01
	Total		$21,602.51

STATEMENT E—Concluded

DAIRY ROTARY FUND

Dr.

To Receipts

For	Sale of cattle	$1,915.75	
"	Sale of milk and cream	7,769.35	
"	Miscellaneous items	45.94	
	Total		$ 9,731.04
	To balance forward July 1, 1920		1,591.26
	Total		$11,322.30

Cr.

By Expenditures

For	Wages	$ 7,200.18	
"	Forage supplies	3,489.10	
"	Wearing apparel	44.10	
"	Freight, express and drayage	217.50	
"	Traveling expense	20.00	
"	General plant service	14.70	
	Total		$10,985.58
	By balance forward		336.72
	Total		$11,322.30

STATEMENT F

Total Receipts and Expenditures of the Ohio Agricultural Experiment Station for the Year ended June 30, 1921

Dr.

To Receipts

From	United States appropriation	$ 30,000.00	
"	State appropriations	265,365.00	
"	Adams Produce Fund	2,541.37	
"	State Produce Fund	14,104.24	
"	Rotary Funds	26,926.27	
	Total		$338,936.88
	To balance forward July 1, 1920		162,549.17
	Total		$501,486.05

Cr.

By Expenditures

For	Salaries	$144,683.97	
"	Wages	91,284.54	
"	Wages, unclassified	188.87	
"	Forage supplies	23,206.60	
"	Fuel supplies	8,311.45	
"	Office supplies	1,549.88	
"	Cleaning supplies	209.01	
"	Agricultural supplies	3,219.85	
"	General plant supplies	9,324.75	
"	Building materials	1,835.88	
"	General plant materials	3,619.86	
"	Office equipment	149.77	
"	Livestock	1,030.25	
"	Agricultural equipment	942.10	
"	Wearing apparel	44.10	
"	Educational equipment	1,001.86	
"	General plant equipment	9,678.46	
"	Repairs	2,175.47	
"	Light, heat and power	173.26	
"	Freight, express and drayage	4,932.42	
"	Traveling expenses	12,999.64	
"	Communication	507.90	
"	General plant service	1,794.50	
"	Rent	2,665.91	
"	Insurance	148.50	
"	Contributions	379.69	
"	Lands	25,951.90	
"	Fencing	599.08	
"	Reservoir	1,475.00	
	Total		$354,084.47
	*State Treasury		14,104.24
	By amount lapsed to State Treasury		90,014.54
	By balance forward		43,282.80
			$501,486.05

*Deposited in State Treasury to the credit of the General Revenue Fund.

STATEMENT G
Balance Sheet, June 30, 1921

Date of appropriation	Appropriation titles	Balance July 1, 1920	Appropriation	Receipts and transfers	Total	Lapsed to State Treasury	Expenditures	Balance June 30, 1921
1917–18	Salaries	$13,870.75			$13,870.75	$13,870.75		
	Wages	12,468.49			12,468.49	12,468.49		
	Wages, unclassified	500.00			500.00	500.00		
	Food supplies	25.00			25.00	25.00		
	Livestock	11.00			11.00	11.00		
	Light, heat and power	301.88			49.45	49.45		
	Greenhouses	165.50			301.88	301.88		
	Addition to smokestack	49.45			165.50	165.50		
	Printing warehouse	10,000.00			10,000.00	10,000.00		
	Water wells	500.00			500.00	500.00		
	Fencing	2.20			2.20	2.20		
	Paving	4.30			4.30	4.30		
	Reservoir	1,500.00			1,500.00	25.00	1,475.00	
	Contributions	1,427.55			1,427.55		332.19	1,095.36
1918–19	Salaries	21,429.61			21,429.61	21,429.61		
	Wages	10,470.55			10,470.55	10,470.55		
	Wages, unclassified	235.41			235.41	235.41		
	Food supplies	22.00			22.00	22.00		
	Forage supplies	5,706.59			5,706.27	5,706.57		
	Fuel supplies	29.11			29.11	29.11		
	Office supplies	1.46			1.49	1.46		
	Cleaning supplies	109.81			109.81	109.81		
	Agricultural supplies	379.72			379.72	379.72		
	General plant supplies	4,542.12			4,542.13	4,542.13		
	General plant materials	96.52			96.52	96.52		
	Office equipment	1.47			1.47	1.47		
	Livestock	1,250.00			1,250.00	1,250.00		
	Wearing apparel	5.47			5.47	5.47		
	Educational equipment	470.20			470.20	470.20		
	General plant equipment	764.96			764.96	764.96		
	Repairs	26.48			26.48	26.48		
	Light, heat and power	337.51			337.51	337.51		
	Transportation	5,047.74			5,047.74	5,047.75		
	Transportation—Other	64.47			64.47	64.47		
	Communication	3.98			3.98	3.98		

STATEMENT G
Balance Sheet, June 30, 1921—Continued

Date of appropriation	Appropriation titles	Balance July 1, 1920	Appropriation	Receipts and transfers	Tota	Lapsed to State Treasury	Expenditures	Balance July 30, 1921
	General plant service	$ 40.89			$ 40.89	$ 40.89		
	Rent	983.91			983.91	983.91		
	Insurance	71.00			71.00	71.00		
1919-20	Salaries	5,767.84			5,767.84			$5,767.84
	Wages	4,072.69			4,072.69		4,072.69	
	Wages, unclassified	200.00			200.00		188.87	11.13
	Food supplies	10.00			10.00			10.00
	Forage supplies	1,582.67			1,582.67		1,582.67	
	Fuel supplies	2,235.18			2,235.18		2,235.18	
	Office supplies	623.04			623.04		623.04	
	Cleaning supplies	168.34			168.34		168.34	
	Agricultural supplies	658.29			658.29		658.29	
	General plant supplies	2,405.06			2,405.06		2,405.06	
	Building materials	760.03			760.03		760.03	
	General plant materials	1,232.80			1,232.80		1,232.80	
	Office equipment	104.24			104.24		104.24	
	Livestock	500.00			500.00		500.00	
	Agricultural equipment	660.00			660.00		660.00	
	Wearing apparel	12.75			12.75			12.75
	Educational equipment	253.65			253.65		253.65	
	General plant equipment	3,135.22			3,135.22		3,135.22	
	Repairs	206.14			206.14		206.14	
	Light, heat and power	2.19			2.19		2.19	
	Freight, express, drayage	69.04			69.04		69.04	
	Traveling expenses	4,475.07			4,475.07		4,475.07	
	Communication	37.87			37.87		37.87	
	General plant service	626.71			626.71		626.71	
							‡700.00	
	Land	28,100.00			28,100.00		25,951.90	1,448.10
	Boiler	3,000.00			3,000.00			3,000.00
	Fencing	604.87			604.87		599.08	5.79
	Rent	474.28		†700.00	1,174.28		1,174.28	
	Insurance	41.25			41.25		41.25	
	Contributions	25.00			25.00		25.00	

STATEMENT G
Balance Sheet, June 30, 1921—Concluded

Date of appropriation	Appropriation titles	Balance July 1, 1920	Appropriation	Receipts and transfers	Total	Lapsed to State Treasury	Expenditures	Balance June 30, 1921
							†1,500.00	
1920–21	Salaries		$140,290.00		$140,290.00		$127,765.11	$11,024.89
	Wages		62,000.00	$1,500.00	63,500.00		63,043.84	456.16
	Wages, unclassified		200.00		200.00			200.00
	Food supplies		10.00		10.00			10.00
	Forage supplies		8,000.00		8,000.00		7,962.72	37.28
	Fuel supplies		7,000.00		7,000.00		6,076.27	923.73
	Office supplies		2,000.00		2,000.00		926.84	1,073.16
	Cleaning supplies		200.00		200.00		40.67	159.33
	Agricultural supplies		2,500.00		2,500.00		2,021.60	478.40
	General plant supplies		7,000.00		7,000.00		5,747.44	1,252.56
	Building materials		1,200.00		1,200.00		1,075.85	124.15
	General plant materials		3,000.00		3,000.00		1,547.43	1,452.57
	Office equipment		200.00		200.00		45.53	154.47
	Livestock		500.00		500.00		55.00	445.00
	Agricultural equipment		1,000.00		1,000.00		282.10	717.90
	Wearing apparel		15.00		15.00			15.00
	Educational equipment		700.00		700.00		677.69	25.31
	General plant equipment		8,000.00		8,000.00		5,440.50	2.559.50
	Repairs		2,000.00		2,000.00		1,805.73	194.27
	Light, heat and power		200.00		200.00		171.07	28.93
	Freight, express		2,000.00	1,000.00	3,000.00		2,704.77	295.23
							†1,000.00	
	Traveling expense		14,000.00		14,000.00		8,504.57	4,495.43
	Communication		500.00		500.00		470.03	29.97
	General plant service		1,200.00		1,200.00		985.50	251.50
	Rent		1,500.00		1,500.00		1,491.63	8.37
	Insurance		100.00		100.00		97.25	2.75
	Contributions		50.00		50.00		22.50	27.50
	Adams Fund		15,000.00		15,000.00		15,000.00	
	Hatch Fund		15,000.00		15,000.00		15,000.00	
	Adams Produce Fund	1,589.32		2,541.37	4,130.79		1,483.95	2,646.74
	Rotary Fund	5,998.54		26,926.27	32,924.81		30,083.08	2,841.73
	Produce Fund			14,104.24	14,104.24		*14,104.24	
	Totals	$162,549.17	$295,365.00	$43,571.88 †3,200.00	$501.486.05 †3,200.00	$90,014.54	$354.084.47 †3,200.00 *14,104.24	$42,282.80

*Deposited in State Treasury to the credit of the General Revenue Fund. †Transfers.

APPENDIX

Monograph Bulletins

of the

Ohio Agricultural Experiment Station

for the year ended June 30, 1921

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